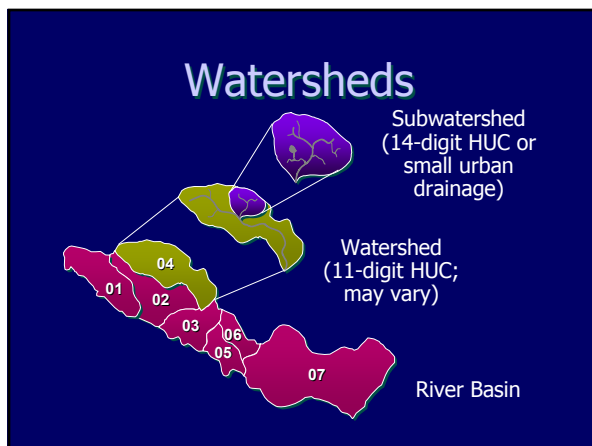


Introduction and background

- Continued focus on impaired waters
- Watershed plans to be developed before BMPS are selected
- 319-funded work plans should be based on the overall watershed plan
- New focus on:
 - Quantitative analysis of current loadings
 - Estimates of pollutant load reductions needed
 - Load reduction potential of specific, planned BMPs
 - Phased implementation of the watershed plan

What is a watershed approach and why use it?

- Geographic Focus
 - Focuses on the resource, not the program
- Sound Science
 - Coordinates data collection efforts, leverages limited resources, streamlines reporting requirements
- Partnerships/stakeholder involvement
 - Builds public support to help ensure lasting solutions
- Iterative Process



Phasing the approach

Start with "Big Picture"

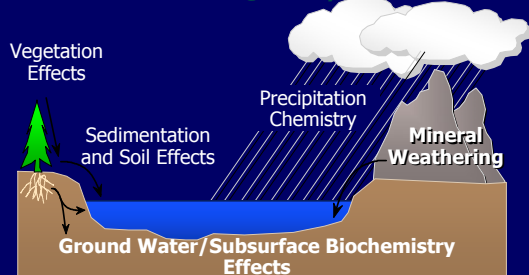
- What do we know?
- Perceptions of watershed issues
- Preliminary goals and objectives



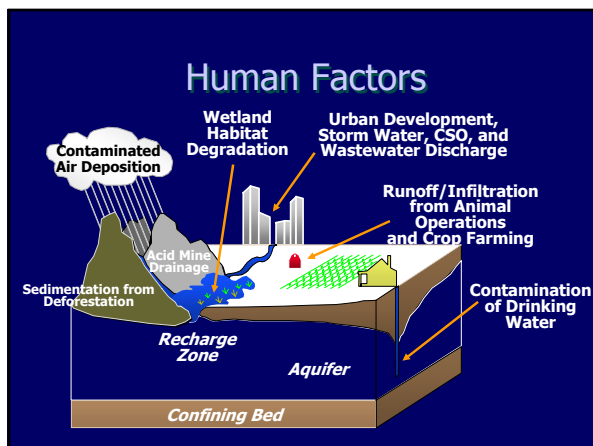
Work toward specifics

- Load reductions needed
- Targeted BMPs
- Implementation Strategy

Natural Factors Affecting Water Quality



Human Factors



A watershed approach helps to...

1. Encourage Sound Science



2. Facilitate Communication and Partnerships



3. Provide Means of Cost-Effective Management



4. Focus on Environmental Results



Watershed Planning Steps



STEP 1 BUILD PARTNERSHIPS

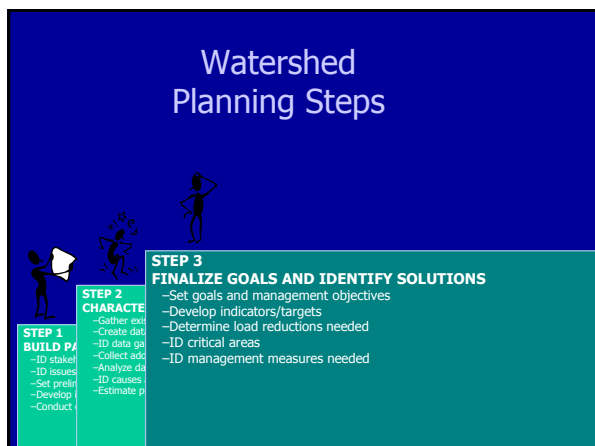
- ID stakeholders
- ID issues of concern
- Set preliminary goals
- Develop indicators
- Conduct outreach

Watershed Planning Steps

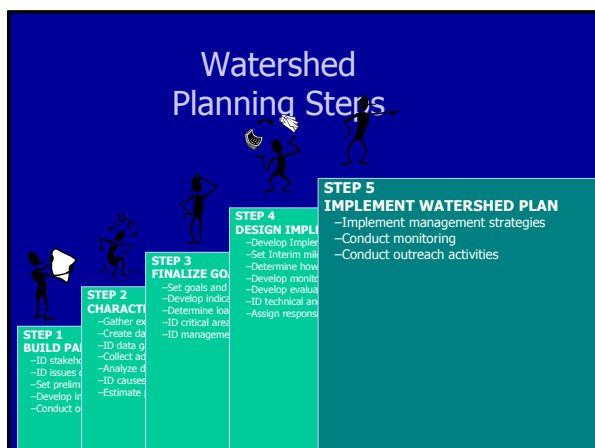


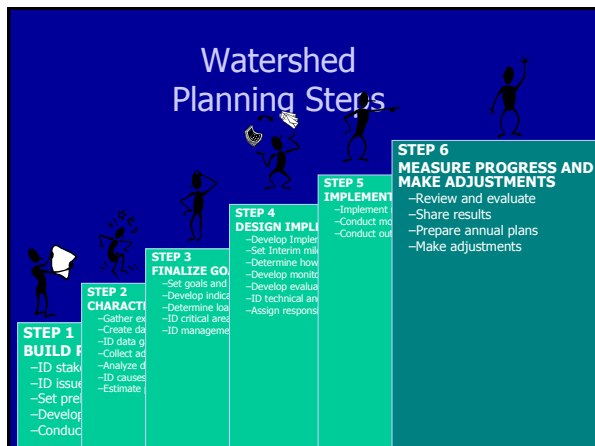
STEP 2 CHARACTERIZE WATERSHED

- Gather existing data
- Create data inventory
- ID data gaps
- Collect additional data, if needed
- Analyze data
- ID causes and sources
- Estimate pollutant loads





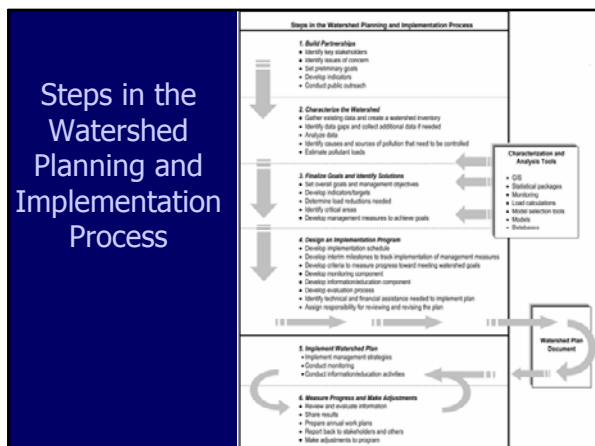


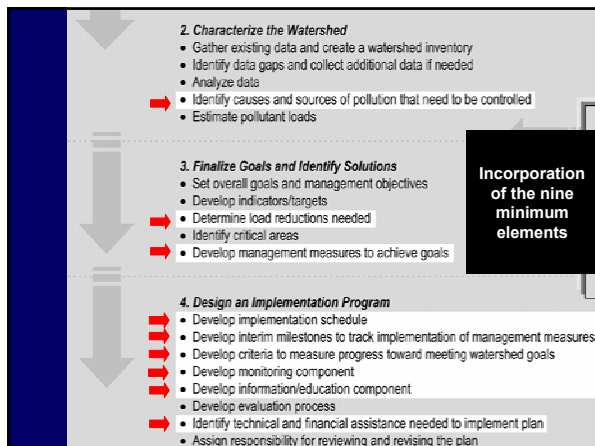


Watershed-Based NPS Plans

- a. Identify stressors & sources to be controlled
- b. Estimate load reductions expected from BMPs
- c. Describe mgmt measures & targeted critical areas
- d. Estimate TA, \$\$, & source required for implementation
- e. Describe info & education needed to promote BMPs
- f. Develop schedule for implementation of BMPs, assign tasks
- g. Describe interim, measurable milestones
- h. Identify criteria to measure progress
- i. Develop monitoring component


Source: US EPA 2004 319 Supplemental Guidelines





Contents of the Watershed Plan

- **Introduction**
 - Plan area & description, partners, background
- **Water quality information & analysis**
 - WQ goals, monitoring/assessment results
 - Key pollutants / stressors, sources, current loads
- **Proposed management measures**
 - Load reductions needed, BMP types proposed
 - Reductions expected from BMPs, installation sites
- **Implementation plan**
 - Public info/education & outreach/involvement plan
 - BMP/\$\$/TA support sources, project schedule & costs
- **Monitoring and adaptive management approach**
 - Interim measurable milestones, load reduction criteria
 - Evaluation framework, monitoring plan & partners



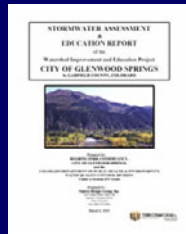
Tools for Watershed Assessment

Figure 6: Monitoring Types and Pollutants or Conditions That They Measure

Biological	Physical	Chemical
Assesses: <ul style="list-style-type: none"> • Structure and function of aquatic communities • Habitat, such as condition of riparian vegetation • Health and abundance of aquatic species or fish populations 	Measures: <ul style="list-style-type: none"> • Temperature • Conductivity • Transparency • Total suspended solids 	Tests for levels of: <ul style="list-style-type: none"> • Pesticides • Organics • Metals (cadmium, arsenic, etc.) • Nutrients (phosphorous, nitrogen) • Toxic materials in fish tissue

Gather Data

- Build on earlier efforts
 - What has already been done?
 - Existing data sets and reports
 - Septic system inventories
 - 305(b) report
 - Wetland inventories
- Consider stakeholder concerns



Gather Data, cont.

- Who has the data?
 - Tribe
 - Neighboring county or town/city agencies
 - State agencies
 - Federal agencies
 - Area environmental or watershed organizations



Types of Data for Watershed Characterization

- **Physical and Natural Features**
 - Watershed boundaries
 - Hydrology
 - Topography
 - Soils
 - Climate
 - Habitat
 - Wildlife
- **Land Use and Population Characteristics**
 - Land use and land cover
 - Existing management practices
 - Demographics
- **Waterbody Conditions**
 - Water quality standards
 - 305(b) report
 - 303(d) list
 - TMDL reports
 - Source Water Protection Areas
- **Pollutant Sources**
 - Point sources
 - Nonpoint sources
- **Waterbody Monitoring Data**
 - Water quality data
 - Flow data
 - Biological data

Sample Data Sources

- Watershed Coverages:
 - 8-digit: <http://water.usgs.gov/GIS/huc.html>
 - 14-digit: www.nrcs.usda.gov/products/datasets/watershed
 - Check tribal or state agencies for small watershed coverages
- EPA Reach Files
 - I.D. and interconnect the stream reaches all over U.S.
 - 3 versions RF1, RF2, RF3-Alpha (most detailed)
 - www.epa.gov/waterscience/ftp/basins/gis_data/huc/
- Elevation Data
 - USGS: <http://edc.usgs.gov/geodata>
 - GIS data depot: <http://data.geocomm.com>
- Land Use/Population
 - USGS: <http://edc.usgs.gov/geodata>
 - EPA: www.epa.gov/nrlc/nlcd.html
- BLM Management Plans
 - www.blm.gov/planning/plans.html

Other Data Sources

- State 303 (d) lists and TMDL reports
 - www.epa.gov/owow/tmdl
- Point source discharge permits
 - www.epa.gov/enviro/html/pes/index.html
- Census of Agriculture
 - www.nass.usda.gov/census
- Septic tank use
 - <http://quickfacts.census.gov/>

Review Data and Identify Gaps

- Do you have enough data to start the analysis?
- What is the quality of the data?
- Do we need to collect more data?
- Conduct visual assessments and research local knowledge

Scoring descriptions

- Channel condition
- Hydrologic alteration
- Riparian zone
- Bank stability
- Water appearance
- Nutrient enrichment
- Barriers to fish movement
- Instream fish cover
- Pools
- Insect/invertebrate habitat
- Canopy cover
- Coldwater fishery
- Warmwater fishery
- Manure presence
- Salinity
- Riffle embeddedness
- Macroinvertebrates observed

<http://www.nrcs.usda.gov/technical/ECS/aquatic/svapfnl.pdf>

Review and Analyze Data

Minimum Element

- a.** An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan.

Characterizing causes & sources

- By "loads"
 - Kilograms per day
 - Pounds per week
 - Tons per month
- Or by other means . . .
 - Concentration-based expression of the "load" (e.g., milligrams per liter)
 - $\text{mg/L} \times \text{L/day} = \text{mg/day}$ [$C = m/v$]
 - # of miles of streambank needing stabilization or vegetation
 - # of AFOs requiring nutrient plans
 - % of urban area to be 'perforated'



Understanding pollution sources

- Point-source discharges (NPDES facilities)
 - Info is available on the discharges (DMRs, etc.)
 - Some are steady-flow, others are precip-driven
- Nonpoint sources (polluted runoff)
 - All are (mostly) precip-driven
 - Calculating the “wash-off, runoff” load is tough!
 - Literature values & etc. can be used to estimate
 - Tribes can use BPJ and narrative descriptions
- Air / atmospheric deposition
 - Can be significant in some locations





Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Pathogens	<ul style="list-style-type: none"> • WWTs • CSOs/SSOs • Permitted CAFOs • Discharges from meat processing facilities • Landfills 	<ul style="list-style-type: none"> • Animals (domestic, wildlife, livestock) • Malfunctioning septic systems • Pastures • Boat pumpout facilities • Land application of manure • Land application of wastewater 	<ul style="list-style-type: none"> • Primarily human health risks • Risk of illness from ingestion or from contact with contaminated water through recreation • Increased cost of treatment of drinking water supplies • Shellfish bed closures
Metals	<ul style="list-style-type: none"> • Urban runoff • WWTs • CSOs/SSOs • Landfills • Industrial facilities • Mine discharges 	<ul style="list-style-type: none"> • Abandoned mine drainage • Hazardous waste sites (unknown or partially treated sources) • Marinas 	<ul style="list-style-type: none"> • Aquatic life impairments (e.g., reduced fish populations due to acute/chronic concentrations of contaminated sediment) • Drinking water supplies (elevated concentrations in source water) • Fish contamination (e.g., mercury)
Nutrients	<ul style="list-style-type: none"> • WWTs • CSOs/SSOs • CAFOs • Discharge from food-processing facilities • Landfills 	<ul style="list-style-type: none"> • Cropland (fertilizer application) • Landscaped spaces in developed areas (e.g., lawns, golf courses) • Animals (domestic, wildlife, livestock) • Malfunctioning septic systems • Pastures • Boat pumpout • Land application of manure or wastewater 	<ul style="list-style-type: none"> • Aquatic life impairments (e.g., effects from excess plant growth, low DO) • Direct drinking water supply impacts (e.g., dangers to human health from high levels of nitrates) • Indirect drinking water supply impacts (e.g., effects from excess plant growth clogging drinking water facility filters) • Recreational impacts (indirect impacts from excess plant growth on fisheries, boating/swimming access, appearance, and odors) • Human health impacts

Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Sediment	<ul style="list-style-type: none"> • WWTs • Urban stormwater systems 	<ul style="list-style-type: none"> • Agriculture (cropland and pastureland erosion) • Silviculture and timber harvesting • Rangeland erosion • Excessive streambank erosion • Construction • Roads • Urban runoff • Landslides • Abandoned mine drainage • Stream channel modification 	<ul style="list-style-type: none"> • Fills pools used for refuge and rearing • Fills interstitial spaces between gravel (reduces spawning habitat by trapping emerging fish and reducing oxygen exchange) • When suspended, prevents fish from seeing food and can clog gills; high levels of suspended sediment can cause fish to avoid the stream • Taste/odor problems in drinking water • Impairs swimming/boating because of physical alteration of the channel • Indirect impacts on recreational fishing
Temperature	<ul style="list-style-type: none"> • WWTs • Cooling water discharges (power plants and other industrial sources) • Urban stormwater systems 	<ul style="list-style-type: none"> • Lack of riparian shading • Shallow or wide channels (due to hydrologic modification) • Hydroelectric dams • Urban runoff (warmer runoff from impervious surfaces) • Sediment (cloudy water absorbs more heat than clear water) • Abandoned mine drainage 	<ul style="list-style-type: none"> • Causes lethal effects when temperature exceeds tolerance limit • Increases metabolism (results in higher oxygen demand for aquatic organisms) • Increases food requirements • Decreases growth rates and DO • Influences timing of migration • Increases sensitivity to disease • Increases rates of photosynthesis (increases algal growth, depletes oxygen through plant decomposition) • Causes excess plant growth

Note: WWT = wastewater treatment plant; CSO = combined sewer overflow; SSO = sanitary sewer overflow; CAFO = concentrated animal feeding operation; DO = dissolved oxygen.

Pollutant	Central business district	Other commercial	Industrial	Single family res.	Multi-family res.	Cropland	Pasture	Forest	Open
TSS	1080	840	56	17	440	450	340	85	7
COD	1070	1020	63	28	330	n.a.	n.a.	n.a.	2.0
Pb	7.1	3.0	2.0 - 7.1	0.1	0.7	0.005 - 0.006	0.003 - 0.015	0.01 - 0.03	n.a.
Zn	3.0	3.3	3.5 - 12	0.22	0.33	0.03 - 0.08	0.02 - 0.17	0.01 - 0.03	n.a.
Cu	2.1	n.a.	0.33 - 1.1	0.03	0.33	0.01 - 0.06	0.02 - 0.04	0.02 - 0.03	n.a.
NO ₃ +NO ₂ -N	4.5	0.67	0.45	0.33	3.8	7.9	0.33	0.56	0.33
TKN	15	15	2.2 - 15	1.1 - 5.6	3.4 - 4.5	1.7	0.67	2.9	1.7
TP	2.8	2.7	0.9 - 4.0	0.2 - 1.5	1.3 - 1.6	0.1 - 3.0	0.07 - 3.0	0.02 - 0.45	0.06

* Exact values are given where available; otherwise ranges are reported.
Adapted from Homer et al. (1986)

Identification of causes & sources

- What "pollutants" are you dealing with?
 - Chemical or other stressors or causes of impairment
- How big is the problem for each?
- How do you know?
 - Did you "measure" them?
 - Did you estimate? How?
- Where are they coming from?
 - Can you put the info on a map?
- Can you estimate the % from each source?



Identifying stressors and sources

- Identify specific causes & sources of water quality impairments or threats
 - Examples: metals from abandoned mine lands, sediment & high flows from urban runoff, habitat loss from channelization, etc.
- Quantify or estimate pollutant sources requiring controls
 - Examples: # of feedlots needing upgrades plus rough average of cattle per lot; number of mine sites needing treatment with estimates and general profiles of flows, etc.
 - Can "bundle" stressors and/or sources



Analyze the Data

- Types of Data Analysis
 - Summary Statistics
 - Spatial Analysis
 - Temporal Analysis
 - Stressor Identification
- Use a combination of techniques
- Consider geographic variations
- Revisit stakeholder concerns

Examples of Sources You Might Miss Without a Watershed Tour

- Streambank erosion
- Straight pipes
- Livestock (near or with access to streams)
- Wildlife (e.g., waterfowl populations on lakes and open streams)
- Illegal dumping

The Bottom Line from US EPA:

- Reasonable efforts needed to ID stressors/sources
- Assessment & other data don't have to be exhaustive, but should be indicative
- Preliminary info & estimates can be modified & corrected over time, if necessary

